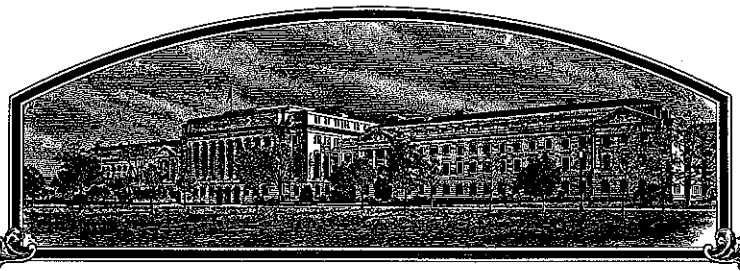


No. 200400242

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Mississippi Agricultural and Forestry Experiment Station

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR PORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE E PURPOSES, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT ED BY THE PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

GAMAGRASS, EASTERN

'HIGHLANDER'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this sixteenth day of July, in the year two thousand and eight.

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Mississippi Agricultural and Forestry Experiment Station

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME

3. VARIETY NAME
Highlander

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
Per request 4-22-08 LMC 5-21-08
Mississippi Agricultural Experiment Station
Mississippi State University
Box 9740
Mississippi State, MS 39762

5. TELEPHONE *(Include area code)*
(662) 325-3005

6. FAX *(Include area code)*
(662) 325-3001

FOR OFFICIAL USE ONLY

PVPO NUMBER
20040024 2

FILING DATE
06/17/04

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
University

8. IF INCORPORATED, GIVE STATE OF INCORPORATION

9. DATE OF INCORPORATION

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
Dr. Vance Watson, Director
Mississippi Agricultural Experiment Station
Mississippi State University
Box 9740
Mississippi State, MS 39762

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 3,652.00
DATE 06/17/04

CERTIFICATION FEE:
$ 768.00
DATE 06-11-08

11. TELEPHONE *(Include area code)*
(662) 325-3005

12. FAX *(Include area code)*
(662) 325-3001

13. E-MAIL
vwatson@dafvm.MsState.edu

14. CROP KIND *(Common Name)*
Eastern gamagrass

16. FAMILY NAME *(Botanical)*
Poaceae

15. GENUS AND SPECIES NAME OF CROP
Tripsacum dactyloides

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ☑ NO

18. DOES THE VARIETY CONTAIN ANY TRANSGENES? ***(OPTIONAL)***
☐ YES ☑ NO
IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERICALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)
- a. ☑ Exhibit A. Origin and Breeding History of the Variety
- b. ☑ Exhibit B. Statement of Distinctness
- c. ☑ Exhibit C. Objective Description of Variety
- d. ☐ Exhibit D. Additional Description of the Variety *(Optional)*
- e. ☑ Exhibit E. Statement of the Basis of the Owner's Ownership
- f. ☑ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
- g. ☑ Filing and Examination Fee ($3,652), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
☑ YES *(If "yes", answer items 21 and 22 below)* ☐ NO *(If "no", go to item 23)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
☑ YES ☐ NO
IF YES, WHICH CLASSES? ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☑ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
1 FOUNDATION 1 REGISTERED 1 CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
☐ YES ☑ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ☑ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
Vance H. Watson		Vance H. Watson	
NAME *(Please print or type)*		NAME *(Please print or type)*	
Vance H. Watson		Vance H. Watson	
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
Director, Mississippi Agricultural &	6-14-04	Director, Mississippi	6-14-04

(See reverse for instructions and information collection burden statement)

ST-470 (04-03) designed by the Plant Variety Protection Office using Word 2002.

INSTRUCTIONS

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to **reproduce** the variety, or for tuber reproduced varieties verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for $3,652 ($432 filing fee and $3,220 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfiled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of $432 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office
Telephone: (301) 504-5518
FAX: (301) 504-5291
Homepage: http://www.ams.usda.gov/science/pvpo/pvpindex.htm

#20040042

To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and provide evidence that name has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: Seed Branch, AMS, USDA, 10301 Baltimore Avenue, Suite 401 NAL Building, Beltsville, MD 20705. Telephone: (301) 504-5682 http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

04 JUN 17 P1:59

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

DRAFT Exhibit A Form

1. Describe the genealogy (back to and including public and commercial varieties, lines, or clones used) and the breeding method(s).

Origin: 'Highlander' (NRCS accession number 9062680) was collected in 1990 by Gregg Brann in Montgomery County, Tennessee. Seeds were collected from plants on the Fort Campbell Army Base along Woodlawn Road at 36°32' latitude and 88°30' longitude. It was growing on a southern exposure on a Dickson silt loam with a 3% slope. Collection site elevation was 182 meters (600 feet) and average annual precipitation for this location is 1016 millimeters (40 inches).

2. Give the details of subsequent stages of selection and multiplication.

Year	Detail of Stage	Selection Criteria
1992-1994	***Method of Breeding:*** 'Highlander' was initially evaluated at the USDA-Natural Resources Conservation Service, Jamie L. Whitten Plant Materials Center (PMC), Coffeeville, Mississippi, from 1992 through 1994. A total of 73 accessions, collected from nine states in the Southeast and southern Great Plains of the United States, were included in the study. From these initial evaluations, Highlander was determined to have superior vigor, growth form and development, and disease resistance (Snider, 1995) (Grabowski, etal, 2005). Snider, J. 1995. Initial Evaluations of Eastern Gamagrass Ecotypes for the Mid-South. Technical Note 6. Jamie L. Whitten Plant Materials Center, Coffeeville, MS. Grabowski, J.M., J.L. Douglas, D.J. Lang, and S.D. Edwards. 2005. Registration of 'Highlander' Eastern Gamagrass.. Crop Science 45: 412-413.	

3a. Is the variety uniform? __X__Yes _____No

How did you test for uniformity?

'Highlander' has been observed for three generations of reproduction and during the seed increase period and is stable and uniform. No variants were observed.

3b. Is the variety stable? __X___ Yes _____ No

How did you test for stability? Over how many generations?

Variety 'Highlander' has been reproduced and judged stable for the past three generations. Variety 'Highlander' is uniform for all traits as described in Exhibit C (Objective Description of Variety). 'Highlander' shows no variants other than what would normally be expected due to environment.

4. Are genetic variants observed or expected during reproduction and multiplication? _____ Yes __X___ No

If yes, state how these variants may be identified, their type and frequency.

Continue on additional pages if necessary.

#200400242

Addendum to Objective Description of Variety General Form for Any Species

The comparison subject, 'Pete' eastern gamagrass was developed by bulking seed from 70 seed collections made in Kansas and Oklahoma (Alderson and Sharp, 1994). The USDA-NRCS Jamie L. Whitten Plant Materials Center in Coffeeville, Mississippi, where these observations were made, is south of its preferred range.

No. of Chromosomes – Highlander is a tetraploid ($2n = 4x = 72$) as determined by ARS, Woodward, Oklahoma. Pete is a diploid ($2n = 2x = 36$) (Dewald, 2001)

Direct seeding – Days from emergence to first flower - Eastern gamagrass is a perennial grass that is slow to establish. Highlander might possibly send up a few scattered flowering culms in the first year; Pete, at least at our location, will not. Highlander will flower from June through August, with the optimum harvest time at our location in north central Mississippi being in mid-July. Pete flowers from May through July to early August and seed harvest period is in mid- to late June.

Supplemental to Exhibit A Form for # 2000400242 (Highlander eastern gamagrass)

Germplasm of eastern gamagrass was assembled at the Jamie L. Whitten Plant Materials Center (Coffeeville, MS) in 1989 and 1990 in the form of seed from 73 accessions collected from nine states for testing. Seed were germinated in the greenhouse then transplanted to the field for further evaluation. During this period of time, germplasm were screened for: foliage height, stem density, leaf size, quantity and fill of seed, and naturally occurring resistance to disease. Accession 9062680 (Highlander) showed moderate foliage height and seed-stem lodging, but high basal stem density, early season vigor and mid-season vigor coupled with wide leaves. Also important for production of a cultivar is the germplasm's ability to produce seed. This is problematic in eastern gamagrass (anonymous, 1987). Accession 9062680 was determined to be desirable because of its relatively short seed head height (213cm in a range of 183-305cm; 84" in a range of 72-120") and seed abundance (rated 3 in a scale of 1-9; were 1 is best).

Based primarily on stem density and seed production capabilities at nine southern Plant Material Centers and at the Mississippi Experiment Station – Prairie, MS., the 13 top performing germplasm populations were selected for further evaluation. Seed from each of these populations were collected to be distributed for further testing to determine dry matter yield among the gamagrass germplasm and versus switchgrass and bermudagrass were conducted. During the winter of 1997-98 conditions allowed substantial build up of disease inoculum at the PMC at Coffeeville. Of the 13 germplasm populations in the screening trials, all eastern gamagrass germplasm succumbed to crown rot, putative causal agent identified as *Pythium*, with *Rhizoctonia*, except accession 9062680 (Highlander). Further yield testing was halted at Coffeeville. Surviving plants of accession 9062680 were identified for seed increase. Seed for all future generations is descended from this genetic material, which has been identified as an obligate apomicts tetraploid (deWalt, personal communication).

#200400242

References:

Alderson, J. and W.C. Sharp. 1994. Grass varieties in the United States. USDA, Agriculture Handbook 170, U.S. Government Printing Office, Washington, DC.

Anonymous. 1987. Gamagrass variant ups seed production 20-fold. Seedmen's Digest Feb 1 p 6.

Dewald, C. 2001. Eastern gamagrass – past, present and future prospectus. Proc. Southern Pasture and Forage Crop Imp. Conf., http://spfcic.okstate.edu/procedures/2001/ecology/dewald.htm

Snider, J. 1995. Initial Evaluations of Eastern Gamagrass Ecotypes for the Mid-South. Technical Note 6. Jamie L. Whitten Plant Materials Center, Coffeeville, MS.

Exhibit B – Statement of Distinctness

1a. Most similar previously existing variety
'Pete'

1b. All previously existing varieties
'Pete', 'Iuka IV', 'Jackson'*

* Seed was not available at the time Highlander was evaluated.

2. Fruit weight, fruit length and width, ploidy level and height.

'Highlander' is similar to 'Pete'; however, 'Highlander' has heavier seed than 'Pete' (Table 1).

Table 1. Weight of 250 fruits of 'Highlander' and 'Pete' eastern gamagrass from seed collected in 2002 and 2003, Coffeeville, Mississippi.

Cultivar	2001	2003
	----------g----------	
Highlander	37.54 a*	32.52 a
Pete	20.99 b	16.81 b

* Means in columns with different letters are significantly different at P<0.05.

'Highlander' is similar to 'Pete'; however, 'Highlander' seed has a longer and wider fruit than 'Pete' (Table 2).

Table 2. Length and width of fruit of 'Highlander' and 'Pete' eastern gamagrass from seed collected in 1999 and 2001, Coffeeville, Mississippi.

Cultivar	1999		2001	
	Length	Width	Length	Width
	----------mm----------			
Highlander	11.3 a*	6.4 a	10.7 a	4.8 a
Pete	8.9 b	4.7 b	8.4 b	4.1 a

* Means in columns with different letters are significantly different at P<0.05.

'Highlander' is similar to 'Pete'; however, 'Highlander' is a tetraploid ($2n = 4x = 72$) (see attached letter) and 'Pete' is a diploid ($2n = 2x = 36$) (Dewald, 2001).

References:

Dewald, C. 2001. Eastern gamagrass – past, present and future prospectus. Proc. Southern Pasture and Forage Crop Imp. Conf., http://spfcic.okstate.edu/procedures/2001/ecology/dewald.htm

USDA

United States Department of Agriculture
Agricultural Research Service

20040242

May 6, 2004

Dr. Joel Douglas
USDA-NRCS
Jamie L. Whitten Plant Materials Center
2533 County Road 65
Coffeeville, MS 38922-2652

Dear Dr. Douglas:

Our laboratory has determined that 'Highlander' eastern gamagrass has (2n=4x=72) chromosomes (tetraploid).

Sincerely,

Tim Springer, Ph.D.
Research Agronomist

Southern Plains Range Research Station • 2000 18th Street
Woodward, OK 73801
580-256-7449 FAX 580-256-1322

EXHIBIT C

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

OBJECTIVE DESCRIPTION OF VARIETY
GENERAL FORM FOR ANY SPECIES

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Mississippi Agricultural and Forestry Experiment Station	per request 4-22-08 PMC 5-21-08	Highlander

ADDRESS (Street and No. or RD No., City, State, Zip Code, and Country)
Mississippi Agricultural Experiment Station
Mississippi State University
Box 9740
Mississippi State, MS 39762

FOR OFFICIAL USE ONLY

PVPO NUMBER
20040242

This is a general form for use when a form for a specific genus and species is not available. Applications of this type are made in species in which few varieties, if any, are commonly known. For that reason, a form cannot be drafted as the span of the variation of most characteristics is not known. In this case, the varieties are described according to the classical Linnaean way. Using a dictionary of botanical terms and this from, describe the characteristics of the application variety on the left side of the form and describe the most similar comparison variety on the right side of the form. Be as specific as possible. Include photographic prints of the varieties.

1. QUALITATIVE TRAITS

Crop Kind (Common Name): Eastern Gamagrass Genus and Species: Tripsacum dactyloides Location Where Developed: USDA-NRCS Jamie L. Whitten PMC Coffeeville, MS	Name of Comparison: Pete Eastern Gamagrass Source of Comparison: USDA-NRCS Manhattan, KS
Preferred Growing Conditions (light, moisture, soil type, pot/bedding/ground cover, etc.): Moist, well drained, fertile soils	Growing Conditions: Moist, well drained, fertile soils
Propagation Method (seed/tuber/cuttings/etc.; inbred/hybrid/open pollinated/etc.; annual/perennial/etc.): Seed, perennial	Propagation Method: Seed, perennial
Whole Plant Habit (herbaceous/woody; upright/prostrate; thorns; tendrils; etc.): Herbaceous, upright	Plant Habit: Herbaceous, upright
Leaf Shape (simple/compound; arrangement of stem; whole leaf shape; leaf margin; leaf base; leaf apex; leaf attachment; leaf venation; pubescence; waxiness; glands; fragrance; etc.): Leaf simple, linear, flat at maturity, midrib prominent, glabrous but scrabrous on the margin	Leaf Shape: Leaf simple, linear, flat at maturity midrib prominent, glabrous but scrabrous on the margin

Flowers (inflorescence type; floret shape; bud; sepals; petals; stigma; stamen; pollen; etc.)
Inflorescence both terminal and axillary, consisting of 1 to 3 spikelet branches with staminate spikelets above and pistillate spikelets below. Staminate spikelets paired, pistillate spikelets solitary.

Fruits (type; surface features; attachment; seeds; etc.)
Seed or grain is enclosed in a hardened fruitcase formed from the glume and rachis internodes

Flowers: Inflorescence both terminal and axillary, consisting of 1 to 3 spikelet branches with staminate spikelets above and pistillate spikelets below. Staminate spikelets paired; pistillate spikelets solitary.

Fruits and Seeds:
Seed or grain is enclosed in a hardened fruitcase formed from the glume and rachis internodes

2. QUANTITATIVE TRAITS

		Trait	Average (Mean)	Standard Deviation	Sample Size	Trait	Average (Mean)	Standard Deviation	Sample Size
		Number of Chromosomes (1N)	See Attached			Number of Chromosomes (1N)			
MATURITY	From Direct Seeding	Days from emergence to first flower	See Attached			Days from emergence to first flower			
		Days from emergence to 50% of plant in flower				Days from emergence to 50% of plant in flower			
		Days from first flower to last flower				Days from first flower to last flower			
	From Trans-Planting	Days from transplant to first flower				Days from transplant to first flower			
		Days from transplant to 50% of plant in flower				Days from transplant to 50% of plant in flower			
		Days from first flower to last flower				Days from first flower to last flower			
	From Pack Trials	Days from emergence to first flower				Days from emergence to first flower			
		Days from emergence to 50% of plant in flower				Days from emergence to 50% of plant in flower			
		Days from first flower to last flower				Days from first flower to last flower			
PLANT		MM Plant Height at Maturity	1076	112.2	20	MM Plant Height at Maturity	878	146.4	20
		MM Plant Width (Spread) at Maturity				MM Plant Width (Spread) at Maturity			
		Number of Stems Arising from Base of Plant				Number of Stems Arising from Base of Plant			
		MM Main Stem Length				MM Main Stem Length			
		MM Main Stem Diameter at Mid-point				MM Main Stem Diameter at Mid-point			
		Number of Branches (arising from lower half of main stem)				Number of Branches (arising from lower half of main stem)			
		Branch Angle from Main Stem				Branch Angle from Main Stem			
LEAVES		Leaf Angle from Main Stem				Leaf Angle from Main Stem			
		MM Width of Leaf	210	20.8	20	MM Width of Leaf	135	17.2	20
		MM Length of Leaf Including Petiole	1379	185.2	20	MM Length of Leaf Including Petiole	989	156.2	20
		MM Thickness of Leaf	1.15	.36	20	MM Thickness of Leaf	.73	.30	20
		MM Length of Petiole				MM Length of Petiole			
		MM Width of Leaflet				MM Width of Leaflet			
		MM Length of Leaflet				MM Length of Leaflet			

INFLORESCENCE		MM Inflorescence Height from Ground	2099	183.3	20	MM Inflorescence Height from Ground	1882	219	20
		MM Inflorescence Width (Diameter)	45	7.3	20	MM Inflorescence Width (Diameter)	25	10.8	20
		MM Depth of Head or Inflorescence	196	31.6	20	MM Depth of Head or Inflorescence	97	19.6	20
		Number of Florets Per Inflorescence	20	4.9	20	Number of Florets Per Inflorescence	17	2.6	20
		MM Length of Peduncle				MM Length of Peduncle			
INDIVIDUAL FLORET		Number of Sepals per Floret				Number of Sepals per Floret			
		Number of Petals per Floret				Number of Petals per Floret			
		Number of Anthers per Floret	3			Number of Anthers per Floret	3		
		Number of Stigmas per Floret	2			Number of Stigmas per Floret	2		
		MM Floret Diameter				MM Floret Diameter			
		MM Eye Diameter				MM Eye Diameter			
		MM Petal Length (ray flower if compositae)				MM Petal Length (ray flower if compositae)			
		MM Petal Width (ray flower if compositae)				MM Petal Width (ray flower if compositae)			
		MM Disk Flower Length (Compositae only)				MM Disk Flower Length (Compositae only)			
		MM Disk Flower Width (Compositae only)				MM Disk Flower Width (Compositae only)			
		MM Sepal Length				MM Sepal Length			
		MM Sepal Width				MM Sepal Width			
INDIVIDUAL FRUIT		MM Fruit Length	10.7	.59	20	MM Fruit Length	8.4	.15	20
		MM Fruit Width	4.8	.75	20	MM Fruit Width	4.1	.51	20
		MM Fruit Thickness	5.5	.60	25	MM Fruit Thickness	4.3	.72	25
		GM Fruit Weight				GM Fruit Weight			
		MM Fruit Rind or Skin Thickness				MM Fruit Rind or Skin Thickness			
		MM Fruit Flesh Thickness				MM Fruit Flesh Thickness			
		Number of Locules (Cavities) per Fruit				Number of Locules (Cavities) per Fruit			
		MM Cavity Width	3.8	.15	15	MM Cavity Width	3.0	.22	15
		MM Cavity Length	8.3	.58	15	MM Cavity Length	7.1	.80	15
		Number of Seeds per Fruit				Number of Seeds per Fruit			
SEEDS		MG Weight per 1000 Seeds Fruits	149	4.8	20	MG Weight per 1000 Seeds Fruits	66	1.5	15
		MM Seed Length	5.1	.53	15	MM Seed Length	4.5	.30	15
		MM Seed Width	3.8	.27	15	MM Seed Width	3.4	.39	15
		MM Seed Thickness	3.5	.30	15	MM Seed Thickness	2.9	.32	15
OTHER									

#200400242

Exhibit C (General)

3. PLANT COLORS

	Color Verbal Name	Color Chart Code	Name of Color Chart		Color Verbal Name	Color Chart Code	Name of Color Chart
Example	Light Blue	106C	RHS				
Hypocotyl Color				Hypocotyl Color			
Cotyledon				Cotyledon			
Brace Root Color				Brace Root Color			
Main Stem Color, Mature				Main Stem Color, Mature			
Leaf or Leaflet Color, Dorsal	Medium Green	7.5Gy5/4	Munsell	Leaf or Leaflet Color, Dorsal	Medium Green	7.5GY5/4	Munsell
Leaf or Leaflet Color, Ventral	Medium Green	7.5Gy5/4	Munsell	Leaf or Leaflet Color, Ventral	Medium Green	7.5GY5/4	Munsell
Leaf or Leaflet Venation Color				Leaf or Leaflet Venation Color			
Leaf Color, Other (describe location or placement)				Leaf Color, Other (describe location or placement)			
Petiole Color				Petiole Color			
Tendril Color				Tendril Color			
Thorn Color				Thorn Color			
Bud (Unopened Flower) Color				Bud (Unopened Flower) Color			
Stigma Color	Red purple	5RP3/4	Munsell	Stigma Color	Red purple	5RP3/6	Munsell
Style Color				Style Color			
Ovary (Immature Flower) Color	Light green	5GY7/6	Munsell	Ovary (Immature Flower) Color	Light green	5GY7/6	Munsell
Pollen Color				Pollen Color			
Anther Color	Orange brwn	5YR6/8	Munsell	Anther Color	Red brwn	2.5YR4/6	Munsell
Filament Color				Filament Color			
Petal Color, Main				Petal Color, Main			
Petal Color, Blotches				Petal Color, Blotches			
Petal Color, Streaks				Petal Color, Streaks			
Petal Color, Spots				Petal Color, Spots			
Petal Color, Veins				Petal Color, Veins			
Petal Color, Eye				Petal Color, Eye			
Petal Color, Throat				Petal Color, Throat			
Petal Color, Disk Flowers (Compositae only)				Petal Color, Disk Flowers (Compositae only)			
Floral Color, Other (describe location or placement)				Floral Color, Other (describe location or placement)			
Sepal Color				Sepal Color			
Mature Fruit Color, Skin	yellow brwn	5Y7/6	Munsell	Mature Fruit Color, Skin	Tan	5Y8/6	
Mature Fruit Color, Flesh				Mature Fruit Color, Flesh			

Fruit Color, Other (describe locatoin or placement) Fruitcase	Yellow Brown	5Y7/6	Munsell	Fruit Color, Other (describe locatoin or placement) Fruitcase	20040242 Tan	5Y8/6	Munsell
Seed Coad Color	Lt brown	7.5YR6/6	Munsell	Seed Coad Color	DK Tan	7.5YR7/6	Munsell
Seed Embryo Color	See Attached			Seed Embryo Color			
Seed Structure Color, Other (describe location or placement) Coleptile	Red Purple	5RP4/6	Munsell	Seed Structure Color, Other (describe location or placement) Coleoptile	Red Purple	5RP5/4	Munsell

Note: Common Color Charts: RHS = Royal Horticultural Society Colour Chart
Munsell = Munsell Book of Color
HCC = Horticultural Colour Chart
BCC = British Colour Council Dictionary of Colour Standards

4. DISEASE, INSECT AND ENVIRONMENT RESISTANCE
(Rate from 1 (most susceptible) to 9 (most resistant))

9 Powdery Mildew	9 Powdery Mildew
___ Other (Specify) _____	___ Other (Specify) _____
9 Aphids	9 Aphids
___ Other (Specify) _____	___ Other (Specify) _____
9 Heat	9 Heat
9 Cold	9 Cold
5 Lodging	5 Lodging
7 Wind	7 Wind
___ Other (Specify) _____	___ Other (Specify) _____

REFERENCES:

Bailey, L.H. 1971. Manual of Cultivated Plants. MacMillan. New York, N.Y.
Hay, R., P.M. Synge. 1991. The Colour Dictionary of Garden Plants with House and Greenhouse Plants. Bloomsbury Books, London.
Munsell Color Chart for Plant Tissues. Macbeth. P.O. Box 230 Newburgh, N.Y. 12551-0230
The Wise Garden Encyclopedia. 1990. HarperCollins Publishers. New York, N.Y.

COMMENTS (Attach photographic prints; Continue in Exhibit D)

Addendum to Objective Description of Variety General Form for Any Species

The comparison subject, 'Pete' eastern gamagrass was developed by bulking seed from 70 seed collections made in Kansas and Oklahoma (Alderson and Sharp, 1994). The USDA-Natural Resources Conservation Service, Jamie L. Whitten Plant Materials Center in Coffeeville, Mississippi, where these observations were made, is south of its preferred range.

No. of Chromosomes – Highlander is a tetraploid ($2n = 4x = 72$) as determined by USDA-Agriculture Research Service, Woodward, Oklahoma (see attached letter). Pete is a diploid ($2n = 2x = 36$) (Dewald, 2001).

Days to Flowering from Direct Seeding - Eastern gamagrass is a perennial grass that is slow to establish. Highlander might possibly send up a few scattered flowering culms in the first year; Pete, at least at our location, will not.

1000 Seed Weight – Opening the fruits to release the seeds (grains) is a destructive and time consuming process. It was feasible to open a few to measure characteristics like size and seed coat color, but not to open large quantities for this measurement. The weights presented are for 1000 fruits or planting units, not 1000 seeds.

Embryo Color – The embryos were too small to accurately determine their coloration.

References:

Alderson, J. and W.C. Sharp. 1994. Grass varieties in the United States. USDA, Agriculture Handbook 170, U.S. Government Printing Office, Washington, DC.

Dewald, C. 2001. Eastern gamagrass – past, present and future prospectus. Proc. Southern Pasture and Forage Crop Imp. Conf., http://spfcic.okstate.edu/procedures/2001/ecology/dewald.htm

Registration of 'Highlander' Eastern Gamagrass

'Highlander' eastern gamagrass [*Tripsacum dactyloides* (L.) L.] (Reg. no. CV-238, PI 634941) is a perennial, native warm-season grass selected at the USDA Natural Resources Conservation Service (NRCS) Jamie L. Whitten Plant Materials Center (PMC), Coffeeville, MS, and released in 2003 in cooperation with the Mississippi Agricultural and Forestry Experiment Station (MAFES) and the NRCS Jimmy Carter PMC, Americus, GA. Highlander was tested under the experimental designation NRCS accession no. 9062680.

This cultivar is an increase of a single seed collection made by Gregg Brann (NRCS Grazing Lands Specialist, Nashville, TN) in Montgomery County, Tennessee in 1990. Highlander was initially evaluated at the Jamie L. Whitten PMC from 1992 to 1994. When compared to 72 other eastern gamagrass accessions collected from nine states in the southeastern USA and southern Great Plains, it exhibited superior vigor, growth form, and disease resistance. It was advanced to a regional trial at six locations and compared to 13 superior eastern gamagrass accessions from southern and western seed sources for forage production. Highlander was the highest yielding accession in the trial (16.1 Mg ha^{-1}) when averaged over all years (1996–1998) at Coffeeville, Americus, GA, Booneville, AR, and Nacogdoches, TX. Yields were lower at Knox City, TX, and Brooksville, FL, where they averaged 9.3 Mg ha^{-1}. At two locations in Mississippi, Highlander produced 19 and 30% more forage than 'Pete' (Fine et al., 1990). When harvested at its recommended 45-d cutting frequency, Highlander yielded approximately 10% more forage than 'Tifton 44' (Burton and Monson, 1978) bermudagrass [*Cynodon dactylon* (L.) Pers.] harvested at its recommended 30-d cutting frequency. Crude protein averaged 110 g kg^{-1}, acid detergent fiber 420 g kg^{-1}, neutral detergent fiber 790 g kg^{-1}, and in vitro true digestibility, determined by procedures of Goering and Van Soest (1970), was 740 g kg^{-1} for the 45-d harvests. It is more susceptible to damage from overgrazing than bermudagrass and requires careful grazing management. Highlander has also demonstrated potential as a perennial silage and biomass crop for energy production and as a nutrient sink for water quality improvement. It is also useable in buffer plantings to provide soil stabilization and wildlife cover.

The range of adaptation for Highlander includes all but the southernmost portions of the southeastern USA, the lower Midwest, and the southeastern portion of the Great Plains. Highlander has grown well on soils ranging from acidic to moderately alkaline and will tolerate wet, poorly drained sites, yet also has fairly good drought tolerance. It is a tetraploid ($2n = 4x = 72$) and reproduces by facultative apomixis. In north central Mississippi, Highlander flowers from May to July, and the optimum seed harvest period is generally in mid-July. Highlander is not an abundant seed producer (approximately 160 kg ha^{-1}), and seeds require specialized cleaning and stratification to overcome mechanical dormancy created by hard fruit coverings.

Breeder seed will be maintained at the USDA-NRCS Jamie L. Whitten Plant Materials Center, Coffeeville, MS. Foundation seed will be maintained at the MAFES Foundation Seed Stock, Mississippi State, MS, and will be sold to producers of registered and certified seed. U.S. Plant Variety Protection will be sought for Highlander.

J.M. Grabowski,* J.L. Douglas, D.J. Lang, and S.D. Edwards

References

Burton, G.W., and W.G. Monson. 1978. Registration of Tifton 44 bermudagrass (Reg. No. 10). Crop Sci. 18:911.

Fine, G.L., F.L. Barnett, K.L. Anderson, R.D. Lippert, and E.T. Jacobson. 1990. Registration of 'Pete' eastern gamagrass. Crop Sci. 30:741–742.

Goering, H.K., and P.J. Van Soest. 1970. Forage fiber analysis (apparatus, reagents, procedures, and some applications). Agric. Handb. 379. U.S. Gov. Print. Office, Washington, DC.

J.M. Grabowski and J.L. Douglas, USDA-NRCS Jamie L. Whitten Plant Materials Center, Coffeeville, MS 38922; D.J. Lang, Miss. State Univ., Dep. Plant and Soil Sci., Mississippi State, MS 39762; S.D. Edwards, USDA-NRCS Alexandria, LA 71302. Registration by CSSA. Accepted 30 June 2004. Published as journal article J10504 of the Mississippi Agricultural and Forestry Exp. Stn. *Corresponding author (Janet.Grabowski@ms.usda.gov).

Published in Crop Sci. 45:412–413 (2005).

677 S. Segoe Rd., Madison, WI 53711 USA

United States Department of Agriculture
NRCS Natural Resources Conservation Service
Plant Guide

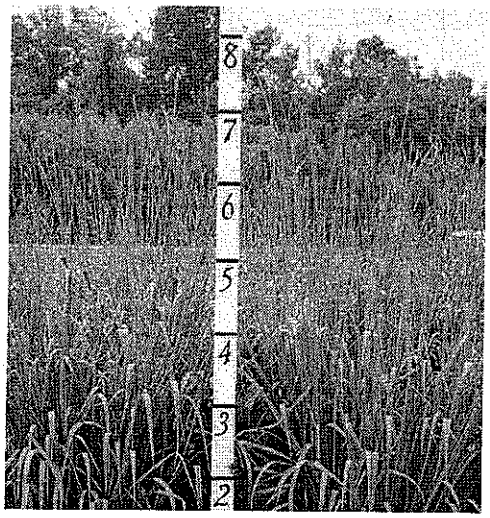
'HIGHLANDER' EASTERN GAMAGRASS

Tripsacum dactyloides (L.)L.

Plant symbol = TRDA3

Contributed by: Jamie L. Whitten Plant Materials Center

Key Web Sites
http://muextension.missouri.edu/explore/agguides/crops/g04671.htm
http://www.sprrs.usda.gov/eastern.htm



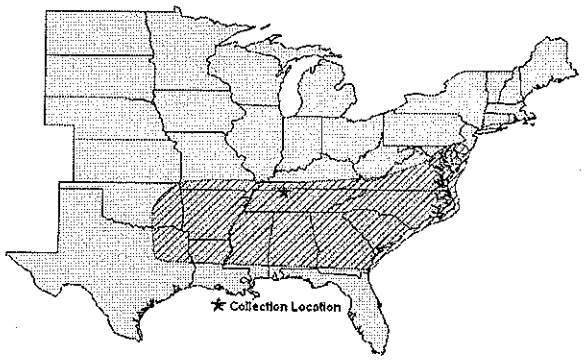
'Highlander' eastern gamagrass was released in 2003 by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Jamie L. Whitten Plant Materials Center (PMC) in Coffeeville, Mississippi with cooperation from the Mississippi Agricultural and Forestry Experiment Station (MAFES), Mississippi State, Mississippi, and the Jimmy Carter PMC, Americus, Georgia (Grabowski et al., 2005).

Uses
Highlander is recommended for forage production. It is best used as a hay crop; however, it can be grazed if given appropriate management (i.e. rotational grazing) to prevent overgrazing and damaging the plant stand. It also has potential as a perennial silage crop, a source of biomass for bioenergy production, and as a nutrient sink for water quality improvement. It can be used in many types of conservation plantings, such as buffers and vegetative barriers.

Status
Please consult the PLANTS Web site (http://plants.usda.gov) and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

Environmental Concerns
Eastern gamagrass is native to the eastern US. It is fairly difficult to establish from seed and therefore has little potential to become a weed in most cropland or wild land settings.

Description
General: Highlander eastern gamagrass is a perennial grass that forms large clumps, with thick, knotty, rhizomes. Mature foliage height ranges from 1.5 to 5 feet tall. The foliage is bluish-green in color; the blades are jagged on the margins and range from less than ½ to slightly over ¾ inch in width. Inflorescences are produced from June to August, with maximum seed production generally occurring in mid-July. Flower stalks are from 5 to 9 feet tall and may lodge when seeds mature. Inflorescence spikes are 6 to 10 inches long, with separate male flowers held above the female flowers. The seed grains are contained in a tough fruitcase. Highlander averages 3150 seed units (grain with fruitcase) per pound. Throughout the remainder of this document, seed units will be referred to as seeds.



Known range of adaptation for Highlander

Distribution: The original seed source for Highlander was collected on the Fort Campbell Army Base in Montgomery County, Tennessee. The area indicated on the map above represents its known range of adaptation. The northern boundary is an estimate because currently available testing has not completely ascertained the northern limit of its range.

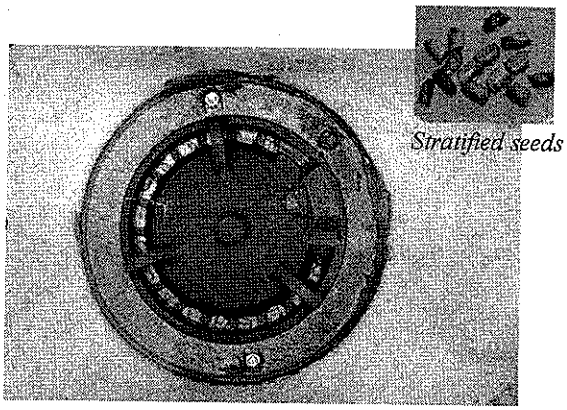
Adaptation

Highlander grows best on well-drained, fertile soils; however, it will tolerate heavier, more poorly-drained soils. It has fairly good flood and drought tolerance. It tolerates a wide range of soil pHs, from fairly acidic to moderately alkaline.

Establishment

Seed dormancy, caused by the hard fruit case, adversely affects establishment. To help overcome this dormancy, seeds should be given a 6 to 10 week cold, moist treatment (stratification) before planting. To stratify seeds, soak them in water for 24 hours, drain, and store them in a refrigerator or cooler set at 35 to 45°F. A fungicide [Thiram (tetramethylthiuram disulfide) is recommended] can be added to the soaking solution. Check the label for recommended treatment rates.

Stratified seeds germinate more quickly when soil temperatures are above 85°F (Anderson, 1985), so if soil moisture is adequate, planting in late spring to early summer is best. An earlier planting date is advisable if insufficient rainfall is expected during the optimum planting period as this will ensure that seeds will not dry out after planting. Fall plantings using non-stratified seeds have been successful in some regions of the country, but are not recommended in the southern portion of Highlander's range because the seeds may not receive sufficient exposure to cold, moist conditions to promote germination.



Stratified seeds

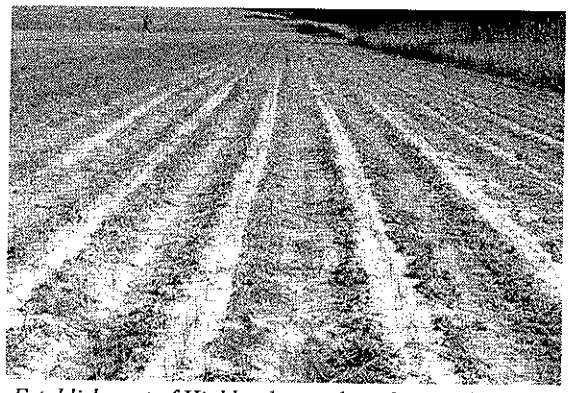
Highlander seeds in planter box of seed drill

Seeds should be drilled in rows spaced a minimum of 24 inches apart for forage production and a minimum of 36 inches apart for seed production. Table 1 lists bulk planting rates for various row spacings when 2 to 4 seeds (first and second number, respectively) are planted per foot of row. To determine the PLS seeding rate for the seed lot you will be using, multiply this rate by the percent PLS of the lot divided by 100. Comparable seeding rates of 'Pete' eastern gamagrass (7200 seeds/lb) are provided for comparison purposes. Seed production requires more uniform stands of Highlander than are necessary for forage production. Therefore, planting more seeds per foot of row is recommended for seed production fields. A target stand for forage production would be approximately one seedling per 18 inches to 2 feet of row; for seed producers, a stand of approximately one seedling per 12 to 15 inches of row would be a desirable stand. Planting several seeds per foot of row compensates for the low germination ability of Highlander. However, if a seed lot has less than 50 percent viable seed, the seeding rate and the number of seeds per foot should be adjusted upwards accordingly.

Table 1. Recommended bulk planting rates for two eastern gamagrass cultivars when planted at various row widths.

	Cultivar	
Row Width (in)	Highlander (lb/ac)	Pete (PMK-24) (lb/ac)
25	13-27†	6-12
30	11-22	5-10
35	9-19	4-8
40	8-17	4-7
45	7-15	3-6

† When 2 to 4 seeds (first and second number respectively) are planted per foot of row.



Establishment of Highlander seed production field

Seeds can be drilled into a prepared seedbed or into killed vegetation. A no-till drill should be used when plant residue is present. The seed metering device in the planter (e.g. plate, picker finger) and the planter settings will be similar to those used for large-sized corn seeds. The most accurate method to calibrate the planter would be to count the number of seeds metered per measured planting distance. However, an estimation of seed numbers can be obtained by weight. Stratified seeds are about 50% heavier than dry seeds and each 100 seeds will weight approximately 22 g. Stratified seeds must not be allowed to

heat up or dry out before planting or they could enter secondary dormancy that will delay germination until the following year. Seeds should be planted 1 to 2 inches deep to prevent drying in the field. Stratification will not overcome dormancy of all viable Highlander seeds, so additional germination often occurs in the year following planting.

Management

Harvest Management: Plants respond favorably to burning in late winter to remove dead leaves from the previous growing season. Highlander requires prudent management for maximizing forage yield and quality (Edwards et al., 2000). The number and timing of harvests depends upon rainfall and other environmental factors. The first harvest is generally made 30 to 40 days after the first application of N fertilizer (see *Nitrogen Fertilization*) with subsequent harvests at 45-day intervals. The final harvest of the growing season is usually made in mid-August or early September to allow the plants at least 6 weeks of regrowth prior to frost. In the mid-South this strategy typically results in three harvests per growing season. A 4 to 6 inch cutting height is recommended. More frequent harvests and cutting below 4 inches will severely damage plant stands.

Grazing: Highlander requires careful grazing management to prevent damage to the stand. Plants should not be grazed during the establishment year and a one-year-old stand should be grazed lightly because the plants are still becoming established. Animals can be put on Highlander in May to June. Once the plants have been grazed to 6 to 8 inches, the animals must be rotated off of the area for about 6 weeks to allow the plants to recover. Using cross-fencing to create several paddocks in the pasture or maintaining multiple pastures are ideal ways to manage Highlander for grazing. The plants should be fertilized using the same regime discussed for mechanical cuttings to ensure that the plants are growing actively.

Nitrogen Fertilization: Highlander responds to N fertilization (Douglas et al., 2002). The first application of N should be at a rate of 40-60 pounds per acre in the spring when regrowth reaches 10 inches. Subsequent applications of 40-60 pounds per acre should be made after each harvest for hay, silage, or grazing, except for the final harvest of the season. Both P and K should be maintained at medium to high levels according to soil test recommendations.

Seed Production

Foundation seed of Highlander is available from the MAFES Foundation Seed Stock for seed production purposes. A row spacing of 40 inches is used for Highlander seed production fields at the Jamie L. Whitten PMC. A single application of N at a rate of 50 to 70 pounds per acre is applied in the spring when regrowth reaches 10 inches (Douglas et al., 2004).

Typical inflorescence of Highlander

Prior to seed maturity, the staminate (male flower) portion of the seedhead will shed. Then the seeds will mature to a dark tan to bronze color. Mature seeds will begin to separate from the seedhead at the joints, beginning with the uppermost one progressing downward. This indeterminate maturity pattern requires fields be inspected regularly, beginning in late June, to assess seed maturity and shattering so that seed harvests can be maximized.

Highlander produces one terminal and three (occasionally four) axillary (lateral) seedheads along a single stem. Seeds of the terminal seedhead mature earlier and generally shatter before seeds on the lateral ones mature. Consequently, harvests should be timed to coincide with maturity of the lateral seedheads to obtain the highest potential yields.

A good indicator of optimum harvest period is when approximately 75% of the lateral seedheads have shed the staminate portion of the inflorescence. At this time, seeds are in different stages of development but it generally favors a higher percentage of the seeds being fully ripe. Combine settings used at the PMC are presented in Table 2 and these can be used as a guide for harvesting Highlander. Settings will vary depending on the make of your combine and physical condition of the seed crop.

Table 2. Recommended combine settings for John Deere 9410 combine for harvesting seed of Highlander eastern gamagrass.

Fan RPM	900-1050
Cylinder Speed	480-520
Concave Setting	12-16
Chaffer	16
Extension	14
Sieve	12

Seed Cleaning

Highlander seeds can be partially cleaned with an air screen cleaner. At the PMC, a Clipper two-screen cleaner with a size 20 round hole screen on the top and an 11 round hole bottom screen are used for this operation. We will usually run the lot through the cleaner twice using these same screens.

Research has shown that air screen cleaners are unable to make a distinct separation of complete seeds (fruitcase + caryopsis) from incomplete seeds (fruitcase + immature or no caryopsis). A gravity separator or air-fractionating aspirator is needed for the final step of the cleaning operation to remove incomplete seeds (Douglas et al., 2000). The PMC has achieved optimum seed separation with a Forsberg pressure gravity separator using a size 8 mesh corrugated deck. The separator ran at a speed of 480 rpm. Pitch and elevation of the deck and fan speed adjustments were based on the physical characteristics of the seed lot being cleaned.

Pests and Potential Problems

An ergot has been observed on seedheads of Highlander. Although it has not been positively identified, this ergot is believed to be *Claviceps tripsaci*, which has previously been reported on eastern gamagrass seedheads (Hardison, 1953). Krizek et al. (2002) discovered southern cornstalk borers (*Diatraea crambidoides*) as a pest in Pete eastern gamagrass in Beltsville, Maryland.

Control

Please contact your local NRCS Field Office, agricultural extension specialist or county weed specialist to learn what controls work best in your area and how to use them safely. Always read label and safety instructions for each control method. Trade names and control measures appear in this document only to provide general information. USDA, NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

References

Anderson, R.C. 1985. Aspects of the germination ecology and biomass production of eastern gamagrass (*Tripsacum dacyloides* L.). Bot. Gaz. 146: 353-364.

Douglas, J.L., J.M. Grabowski, and B.C. Keith. 2000. A comparison of seed cleaning techniques for improving quality of eastern gamagrass seed. Seed Sci. and Technol. 28: 163-167.

Douglas, J.L., J.M. Grabowski, D.J. Lang, P.D. Meints, and R.L. Elmore. (in press). Influence of nitrogen fertilization on seed production of eastern gamagrass in northern Mississippi. *In* Proc. of the Fourth Eastern Native Grass Symposium, October 4-6, 2004, Univ. of Kentucky, Lexington, KY

Douglas, J.L., S.D. Edwards, D.L. Lang, R.L. Elmore, R.L. Ivy, and J.L. Howell. 2004. Eastern gamagrass response to nitrogen fertilization in northern Mississippi. p. 240-247. *In* J. Randall and J.C. Burn (eds.) Proc. of the Third Eastern Native Grass Symposium. The North Carolina Botanical Garden, Chapel Hill, NC, October 1-3, 2002. Omnipress, Madison, WI.

Edwards, S.D., J.L. Douglas, and H. Bloodworth. 2000. Clipping effects on yield and quality of eastern gamagrass, switchgrass, and bermudagrass. p. 121-126 *In* J.C. Ritchie, J.A. Dickerson, and C.A. Ritchie (eds.) Proc. of the Second Eastern Native Grass Symposium, Baltimore, MD, November 17-19, 1999. USDA-Agricultural Research Service, and USDA-Natural Resources Conservation Service, Beltsville, MD.

Grabowski, J.M., J.L. Douglas, D.J. Lang, and S.D. Edwards. 2005. Registration of 'Highlander' eastern gamagrass. Crop Sci. 45: 412-413.

Hardison, J.R. 1953. Seed disorders of forage plants. p. 272-276. *In* A. Stefferud (ed.) Plant Diseases the Yearbook of Agriculture. U.S. Gov. Printing Office, Washington, DC.

Krizek, D.T., M.A. Solis, P.A. Touhey, J.C. Ritchie, and P.D. Millner. 2002. Rediscovery of the southern cornstalk borer: a potentially serious pest of eastern gamagrass and strategies for mitigation. p.277-283. *In* J. Randall and J.C. Burn (eds.) Proc. of the Third Eastern Native Grass Symposium. The North Carolina Botanical Garden, Chapel Hill, NC, October 1-3, 2002. Omnipress, Madison, WI.

Prepared By:
Janet M. Grabowski and Joel L. Douglas

April 2005

For more information about this and other plants, please contact your local NRCS field office or Conservation District, and visit the PLANTS Web site<http://plants.usda.gov> or the Plant Materials Program Web site <http://Plant-Materials.nrcs.usda.gov>

REPRODUCE LOCALLY. Include form number and edition date on all reproductions. FORM APPROVED - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME
Mississippi Agricultural and Forestry Experiment Station per request 4-22-08	NRCS 9062680	Highlander
4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)* LMC 5-21-08 Mississippi Agricultural Experiment Station Mississippi State University Box 9740 Mississippi State, MS 39762	**5. TELEPHONE** *(Include area code)* (662) 325-3005	**6. FAX** *(Include area code)* (662) 325-3001
	7. PVPO NUMBER 20040042	

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** ☑ **YES** ☐ **NO**

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country.** ☑ **YES** ☐ **NO**

10. Is the applicant the original owner? ☐ **YES** ☑ **NO** **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
☐ **YES** ☐ **NO** **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
☑ **YES** ☐ **NO** **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

Highlander is a joint release with the USDA-Natural Resources Conservation Service. Selection and testing was jointly conducted by the owner and the USDA.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

EXHIBIT F
DECLARATION REGARDING DEPOSIT

NAME OF OWNER (S)	ADDRESS *(Street and No. or RD No., City, State, and Zip Code and Country)*	TEMPORARY OR EXPERIMENTAL DESIGNATION
Mississippi Agricultural and Forestry Experiment Station	Mississippi State University Box 9740 Mississippi State, MS 39762	Highlander **VARIETY NAME**
NAME OF OWNER REPRESENTATIVE (S)	**ADDRESS** *(Street and No. or RD No., City, State, and Zip Code and Country)*	FOR OFFICIAL USE ONLY
Dr. Vance Watson, Director	Mississippi Agricultural and Forestry Experiment Station Mississippi State University Box 9740 Mississippi State, MS 39762	**PVPO NUMBER** #200400242

I do hereby declare that during the life of the certificate a viable sample of propagating material of the subject variety will be deposited, and replenished as needed periodically, in a public repository in the United States in accordance with the regulations established by the Plant Variety Protection Office.

Vance H. Watson
Signature

1 Feb 2007
Date

21